Role of CEOS Working Group on Calibration and Validation in Analysis Ready Data Products

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CEOS Analysis Ready Data for Land (CARD4L)

CARD4L are satellite data processed to a minimum and organized to allow users to analyze with minimum of additional effort

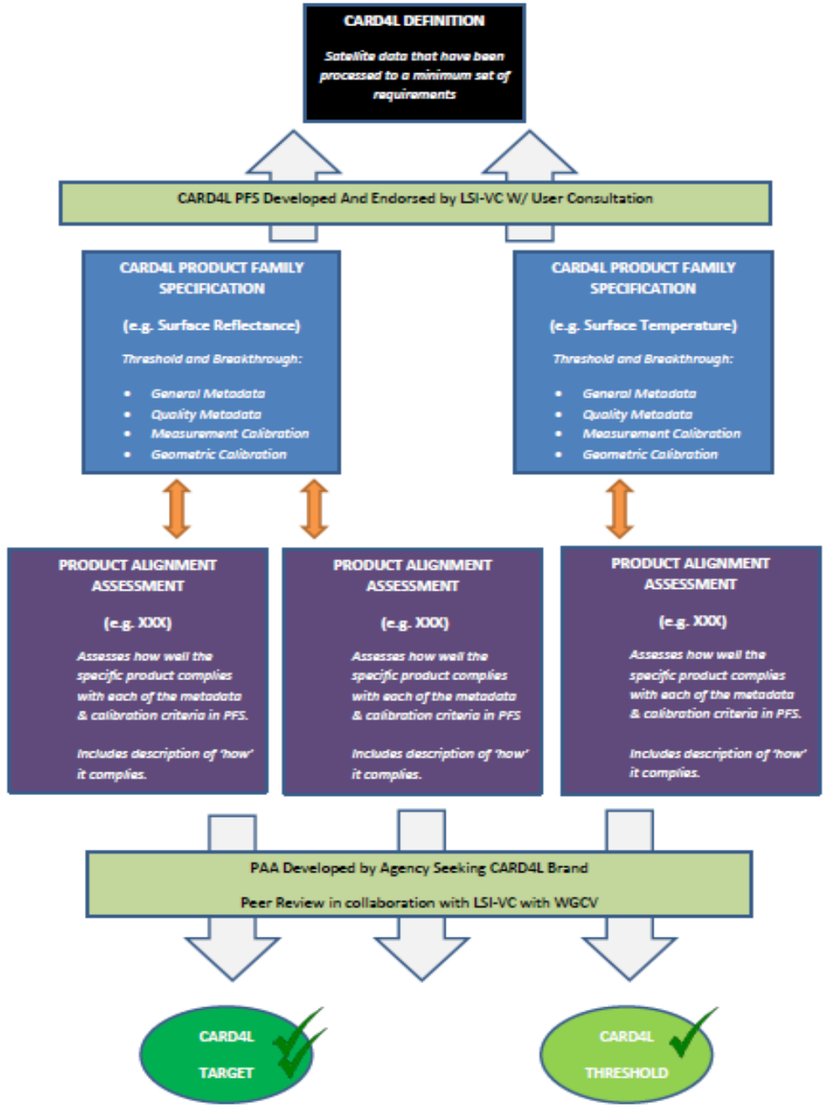
- Benefits for data producers and providers can include
  - Attracting interest from potential new users
  - Simplifying data distribution
- Benefits to users include
  - Saving time
  - Reducing costs
  - Leveraging expertise of data producers

More informations: http://ceos.org/ard/

CARD4L Framework

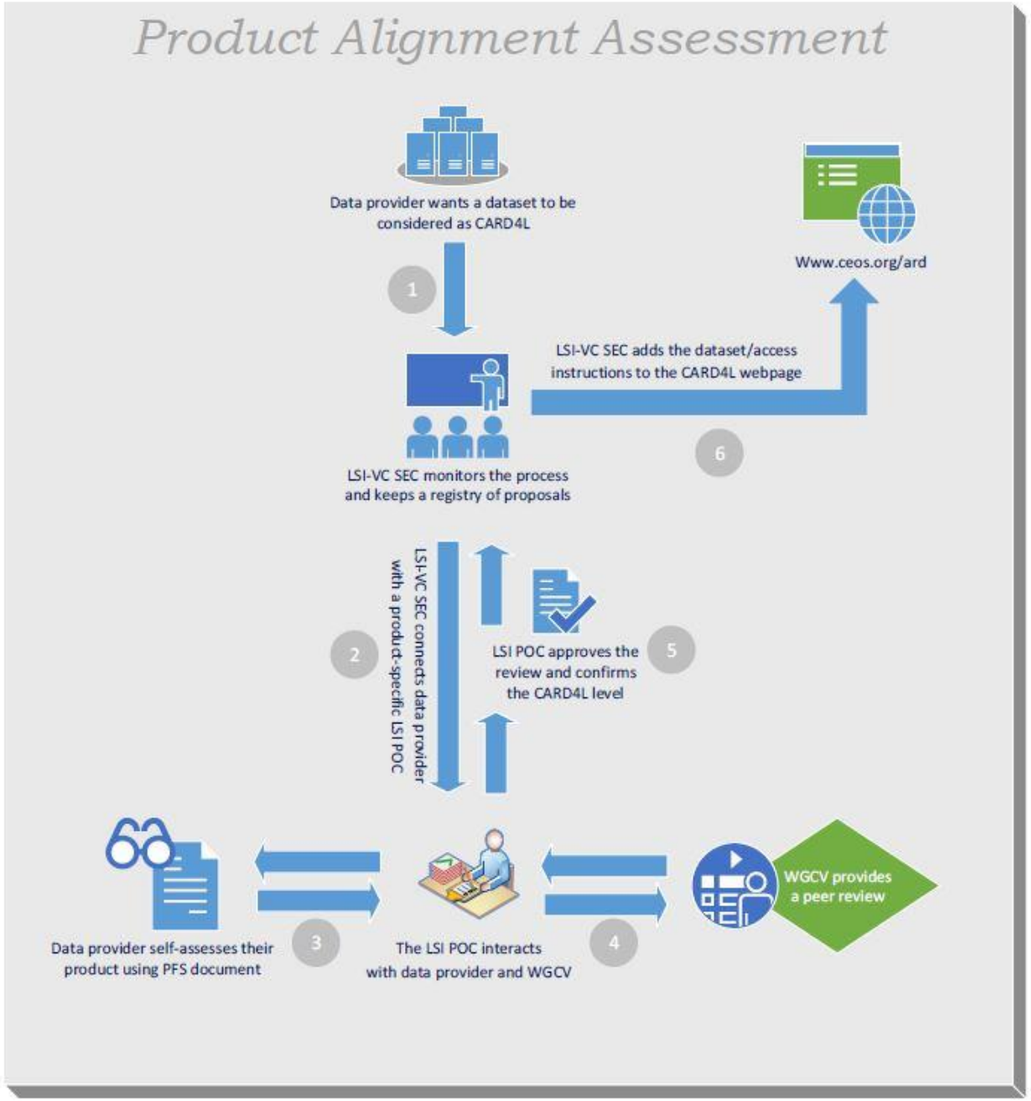
CEOS Land Surface Imaging Virtual Constellatior (LSI-VC) team has been leading this initiative

- Product Family Specifications for three products
  - Optical Surface Reflectance (CARD4L-OSR)
  - Surface Temperature (CARD4L-ST)
  - Normalized Radar Backscatter (CARD4L-NRB)
- Providers self-assess how well their products meet the specifications
- Self-assessment peer reviewed by CEOS Working Group on Calibration and Validation (WGCV)
- CARD4L-compliance



CARD4L Framework

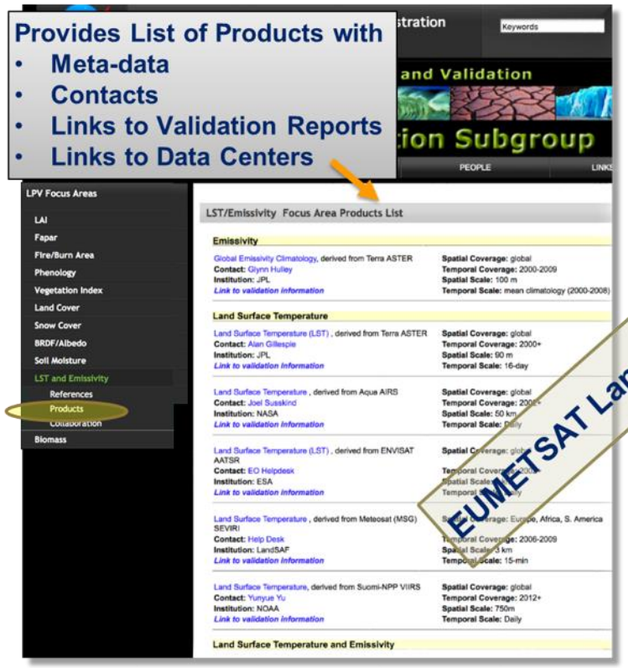
- Three core elements
  - Definition of CARD4L
  - Product Family Specification (PFS)
  - Product Alignment Assessment (PAA)
- Many data products being produced and distributed are already very close to what could be considered ARD
- CARD4L guidance will provide the data providers with changes that allow their products to satisfy full CARD4L specifications

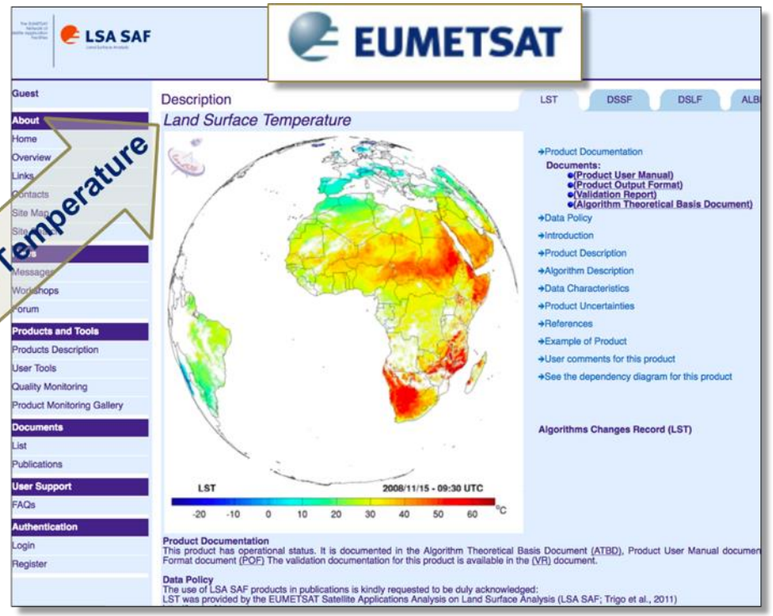


CEOS WGCV

- WGCV is composed of agency members and six subgroups
  - Atmospheric composition
  - Infrared and visible optical sensors
  - Land product validation
  - Microwave
  - Synthetic aperture radar
  - Terrain mapping
- Key parts of WGCV include
  - Data interoperability and harmonization for the global remote sensing community
  - Forum for exchange of instrument calibration/validation approaches and results
  - Promoting coordinated activities such as laboratory and field measurement comparisons
  - Quality Assurance Framework for Earth Observation (QA4EO) which includes a set of baseline quality assurance methods to facilitate data interoperability

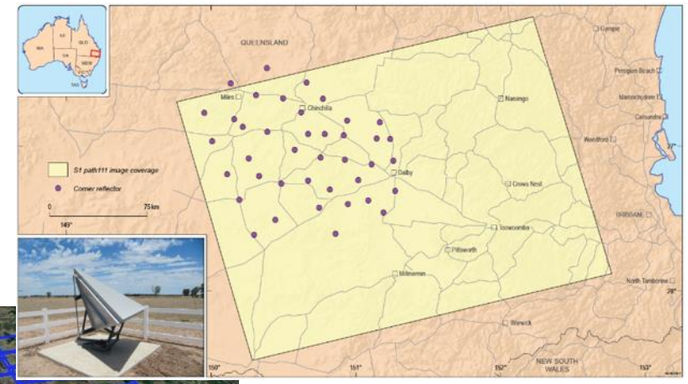
WGCV documenting validation framework and protocols and methods





EUMETSAT Land Surface Temperature

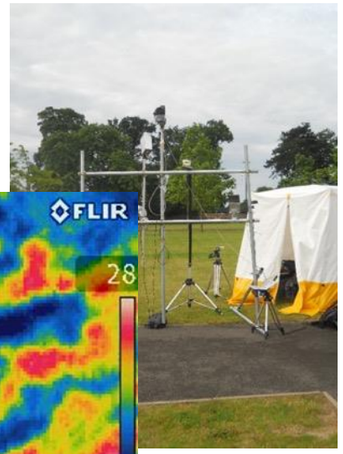
LPV's - Land Surface Temperature & Emissivity Focus Area

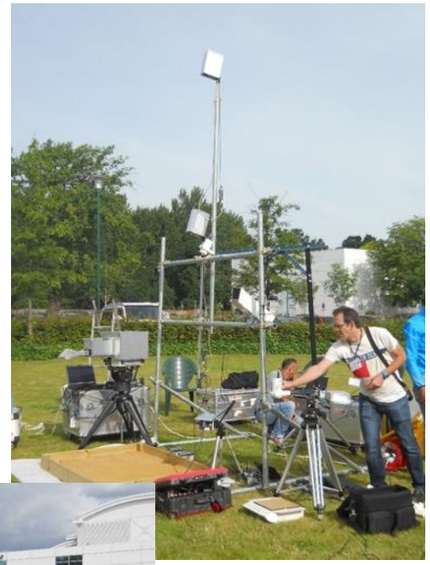


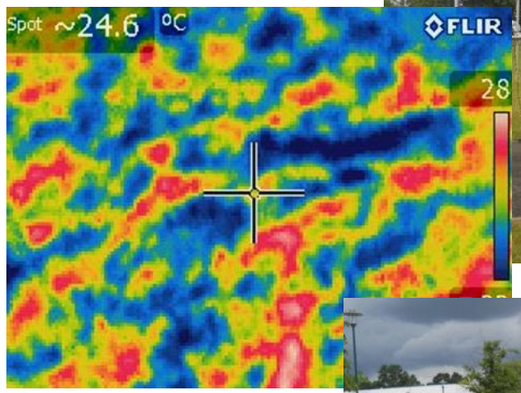
SAR subgroup's database of deployed corner reflector sites available from Point and Distributed Targets Database: http://sarcv.ceos.org/targets/target_group/4

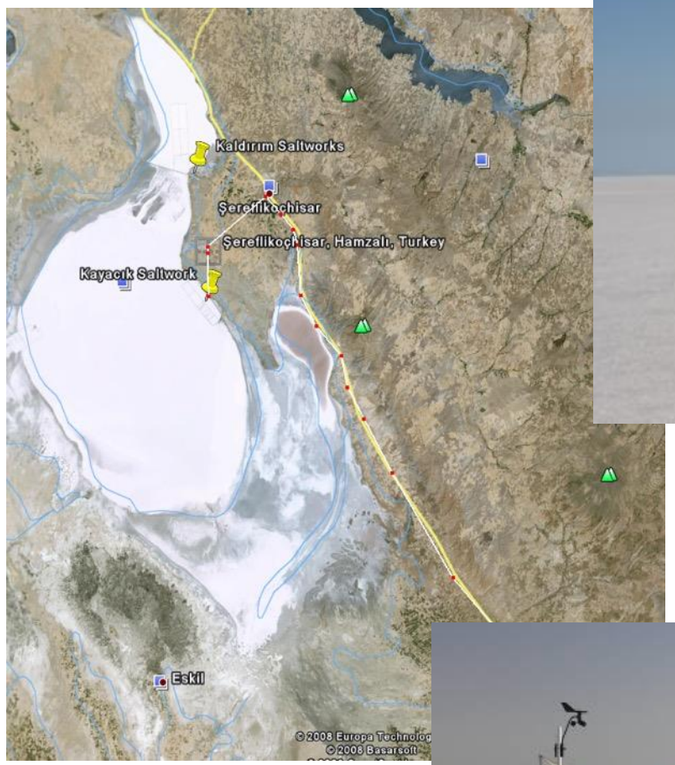
WGCV round-robin activities

LST and emissivity









Surface reflectance

WGCV Atmospheric Correction Intercomparison Experiment (ACIX)

Processors \ Sensors	
1	ACOLITE [Belgium]
2	ATCOR [Germany]
3	Brockmann [Germany]
4	FORCE [Germany]
5	GA-PABT [Australia]
6	LaSRC [USA]
7	LAC [France]
8	MACCS [France]
9	OPERA [Belgium]
10	SCAPE-M [Germany]
11	SeaDAS [USA]
12	Sen2Cor [France&Germany]

Better understanding of the different uncertainty contributors and help in improving the AC processors

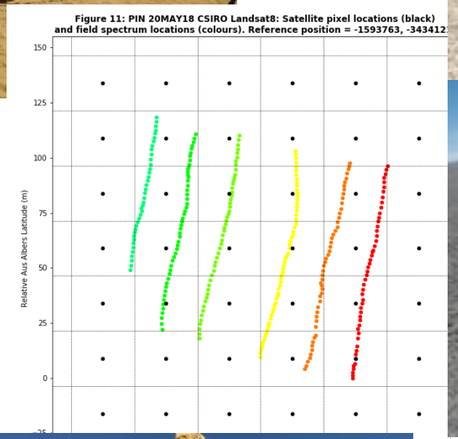
- Defined inter-comparison protocols
- Participants applied their AC schemes for test sites keeping processing parameters constant
- ACIX coordinators processed the results submitted by all participants in early 2017
- Peer-reviewed paper published in 2018 with details
- ACIX2 began in October 2018 along with a cloud mask intercomparison

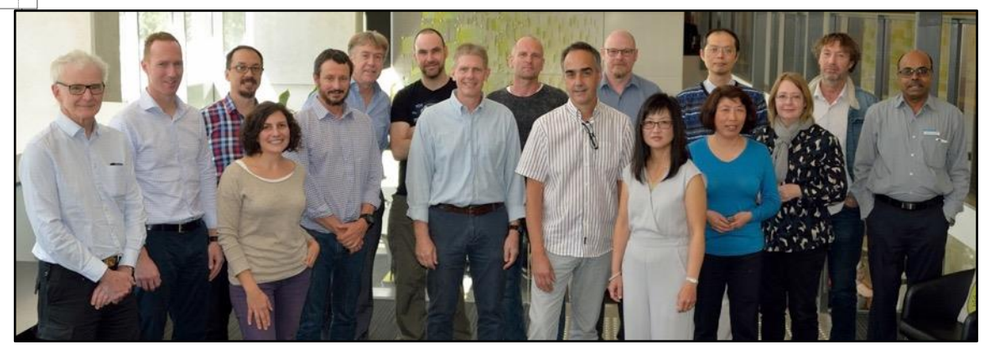
Continental scale surface reflectance validation

Leveraging activities of multiple agencies

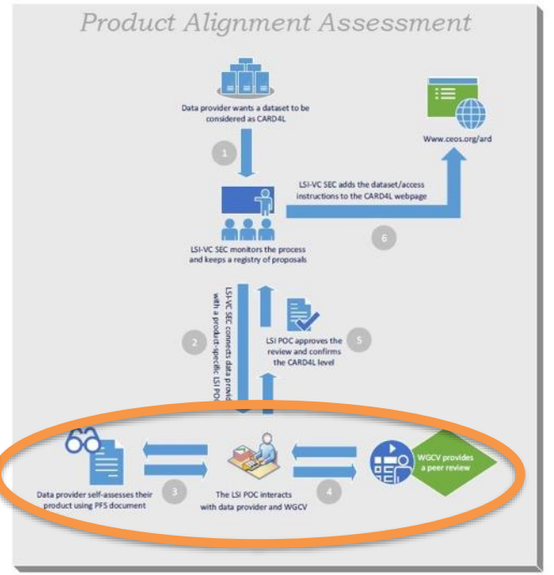
- Guidance on validation methodologies and protocols
  - Instrumentation
  - Traceability
  - Site sampling
  - Site selection
  - Uncertainties

Results will have direct impacts on CARD4L as well as ACIX II





Product Alignment Assessment includes Self-assessment peer reviewed by (WGCV)



- PFS point of contact interacts with Data Provider and WGCV to
  - Verify Data Provider's Product Self-Assessment
  - Obtain feedback from WGCV on the Product's Cal/Val process

WGCV peer review of CARD4L Self Assessments

WGCV approach is a collaborative process to help data provider produce documentation that follows accepted practices

- One analogy put forward by the CEOS CEO (S. Hosford) is that Product Family Specifications describe the final dish but does not describe the recipe
- WGCV will help assess that the recipe is documented properly

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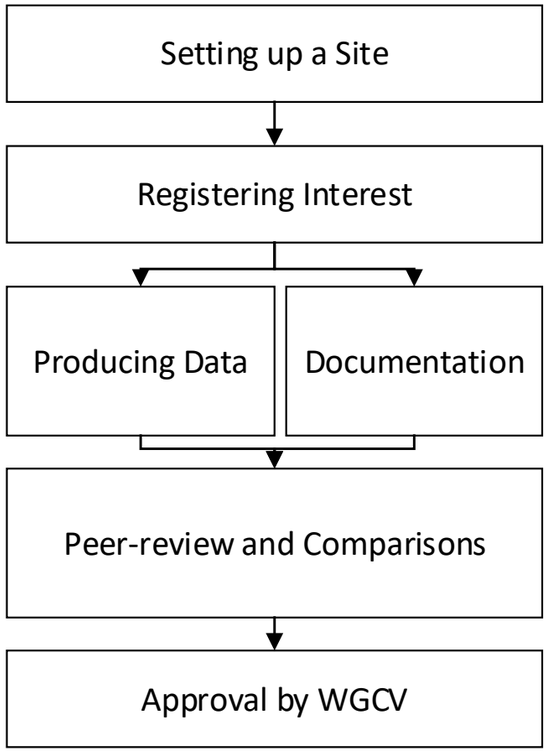
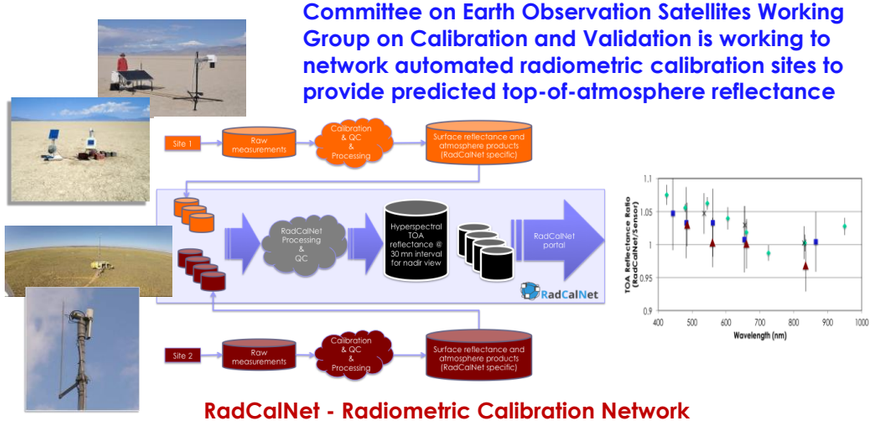
WGCV assessment

WGCV recently developed a similar process for RadCalNet that is very similar to the PAA path proposed by LSI-VC for CARD4L

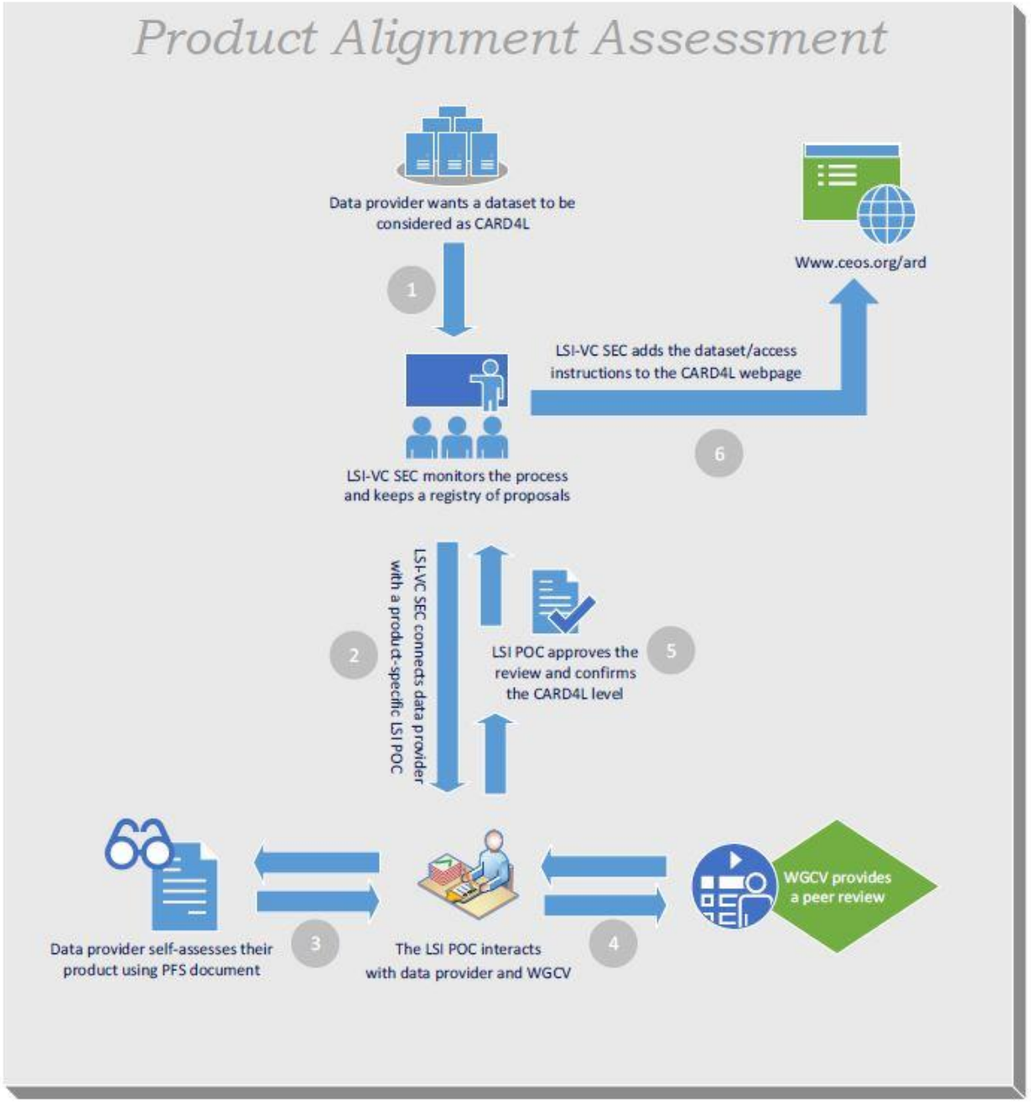


RadCalNet

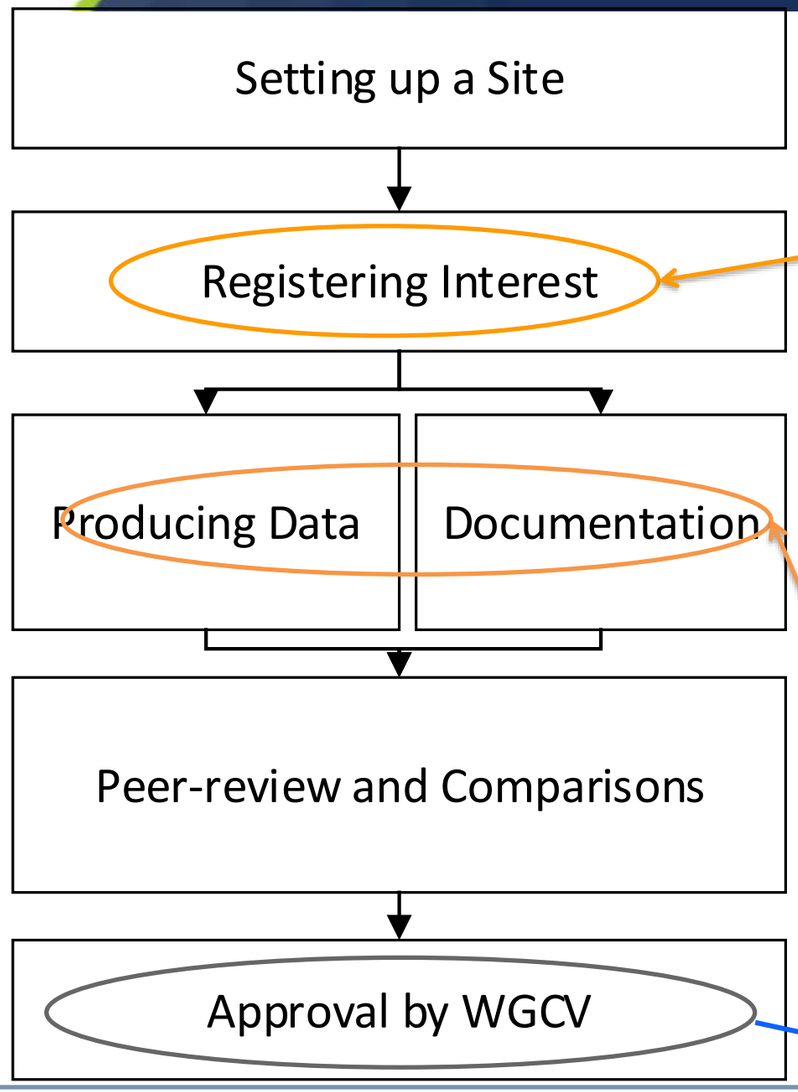
Committee on Earth Observation Satellites Working Group on Calibration and Validation is working to network automated radiometric calibration sites to provide predicted top-of-atmosphere reflectance

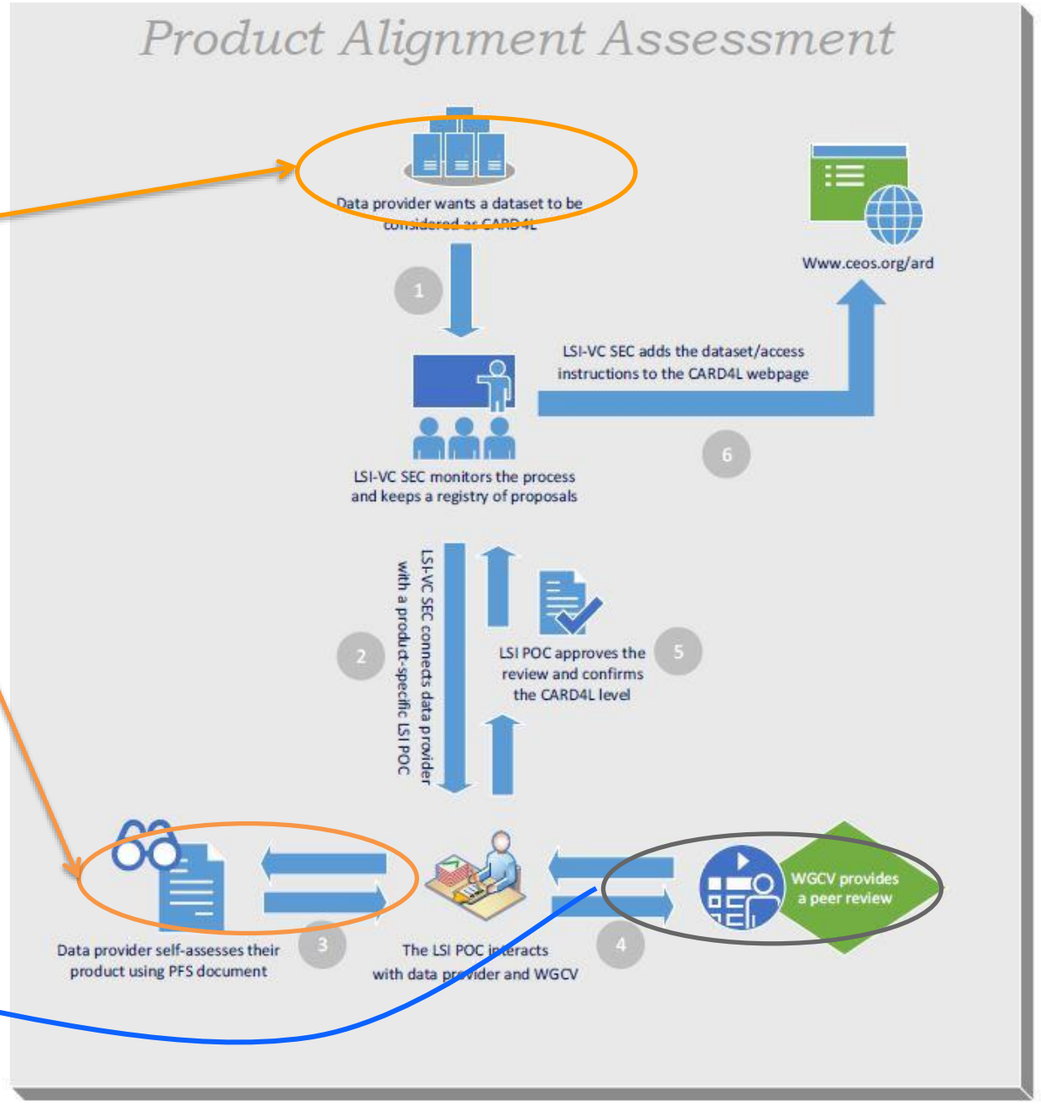


RadCalNet - Radiometric Calibration Network



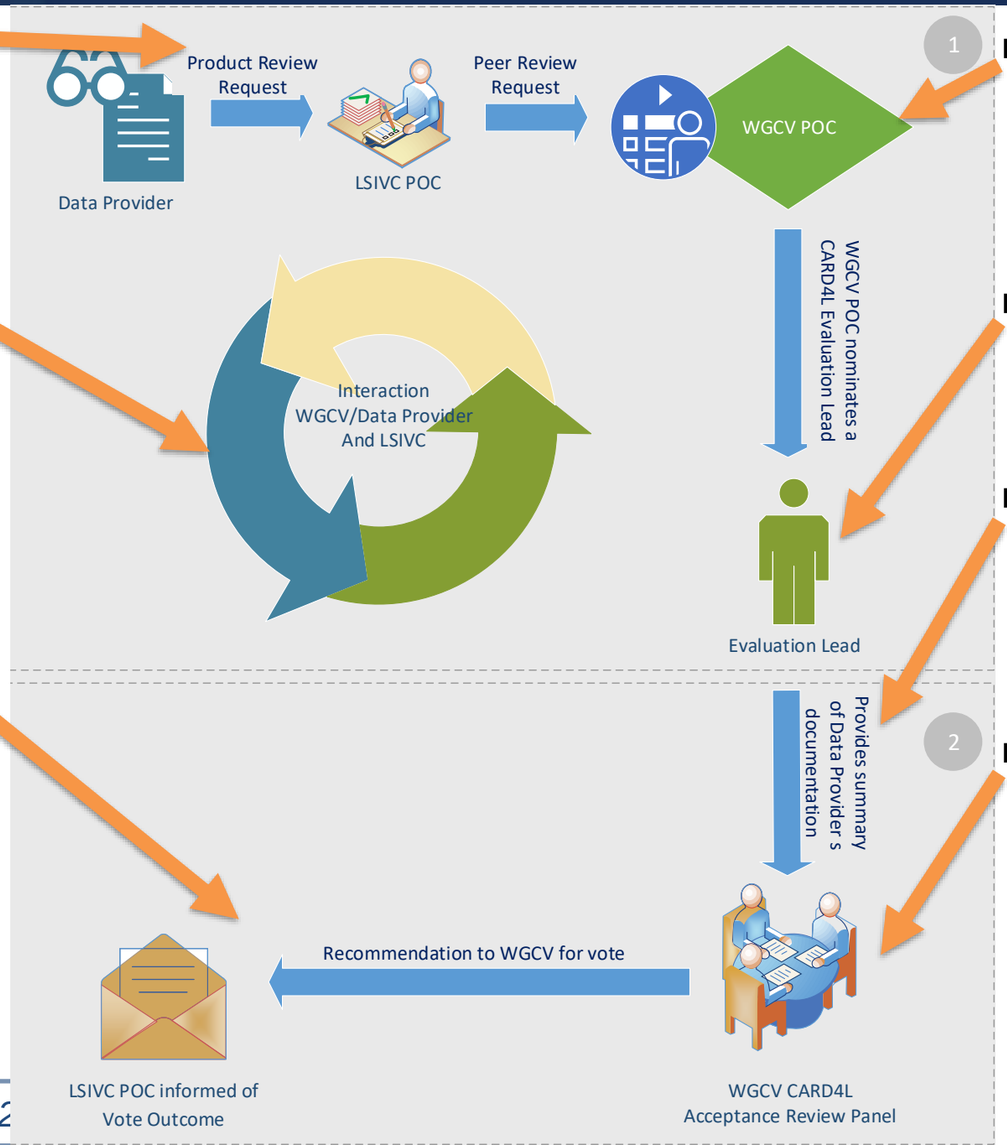
WGCV RadCalNet and CARD4L assessment processes





WGCV assessment

- Evaluation begins with data provider expressing interest in having data product evaluated
- WGCV evaluator works with LSI point of contact and the data provider to assess product's documentation of their validation process
- WGCV membership then votes on recommendation and provides LSI POC and Data Provider with result of WGCV vote

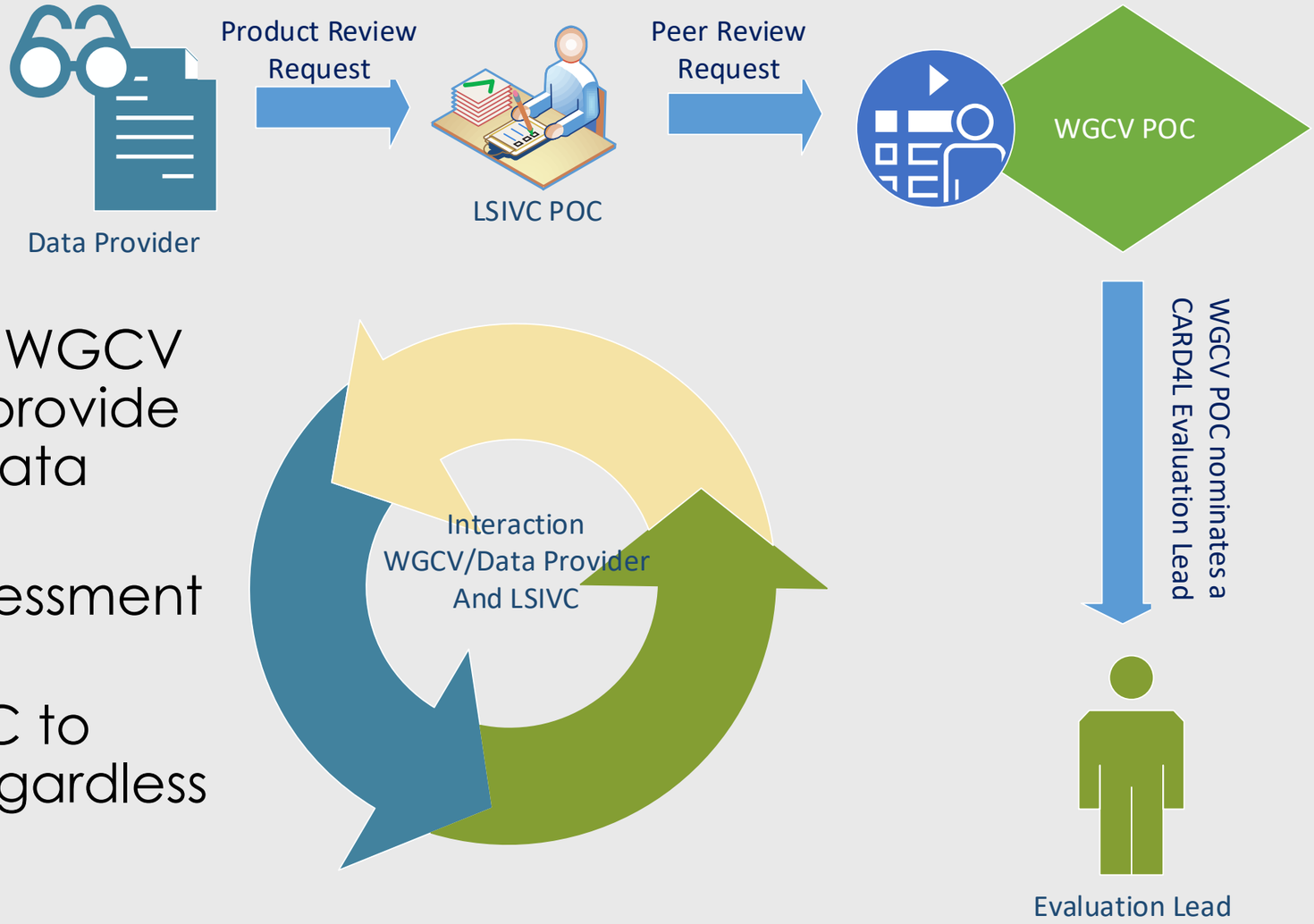


- Data provider documentation provided to WGCV CARD4L evaluation lead
- WGCV subject matter expert acts as evaluator of documentation
- WGCV evaluator develops summary document and a recommendation
- WGCV membership then votes on recommendation and provides LSI POC and Data Provider with result of WGCV vote

WGCV CARD4L Assessment Evaluation Lead

CARD4L Evaluation Lead acts as single point of contact to simplify process for LSI-VC

- Determines best person within WGCV with appropriate expertise to provide a detailed evaluation of the data provider's documentation
- WGCV Evaluator does the assessment for WGCV
- Allows initial contact for LSI-VC to always be the same person regardless of the product



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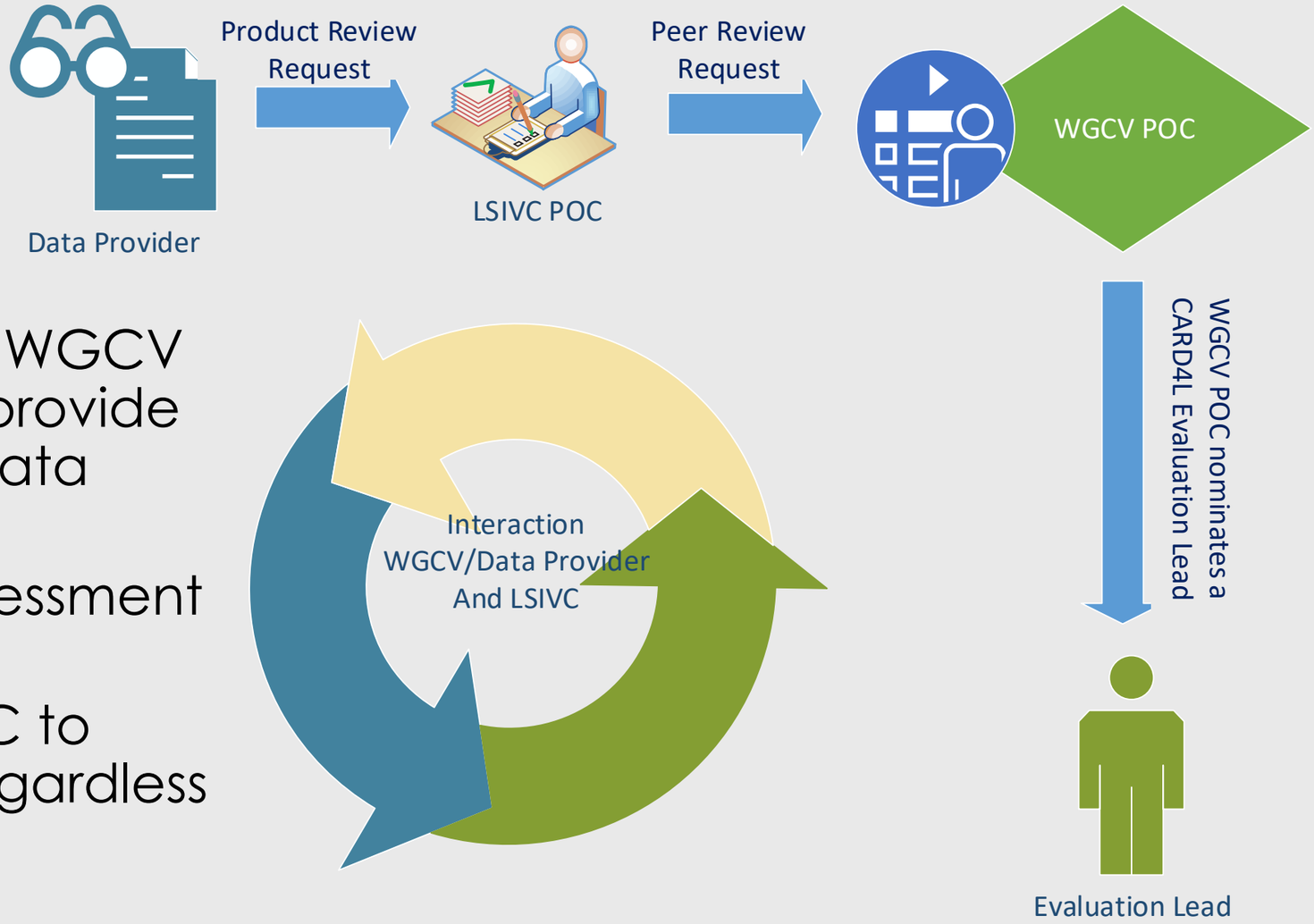
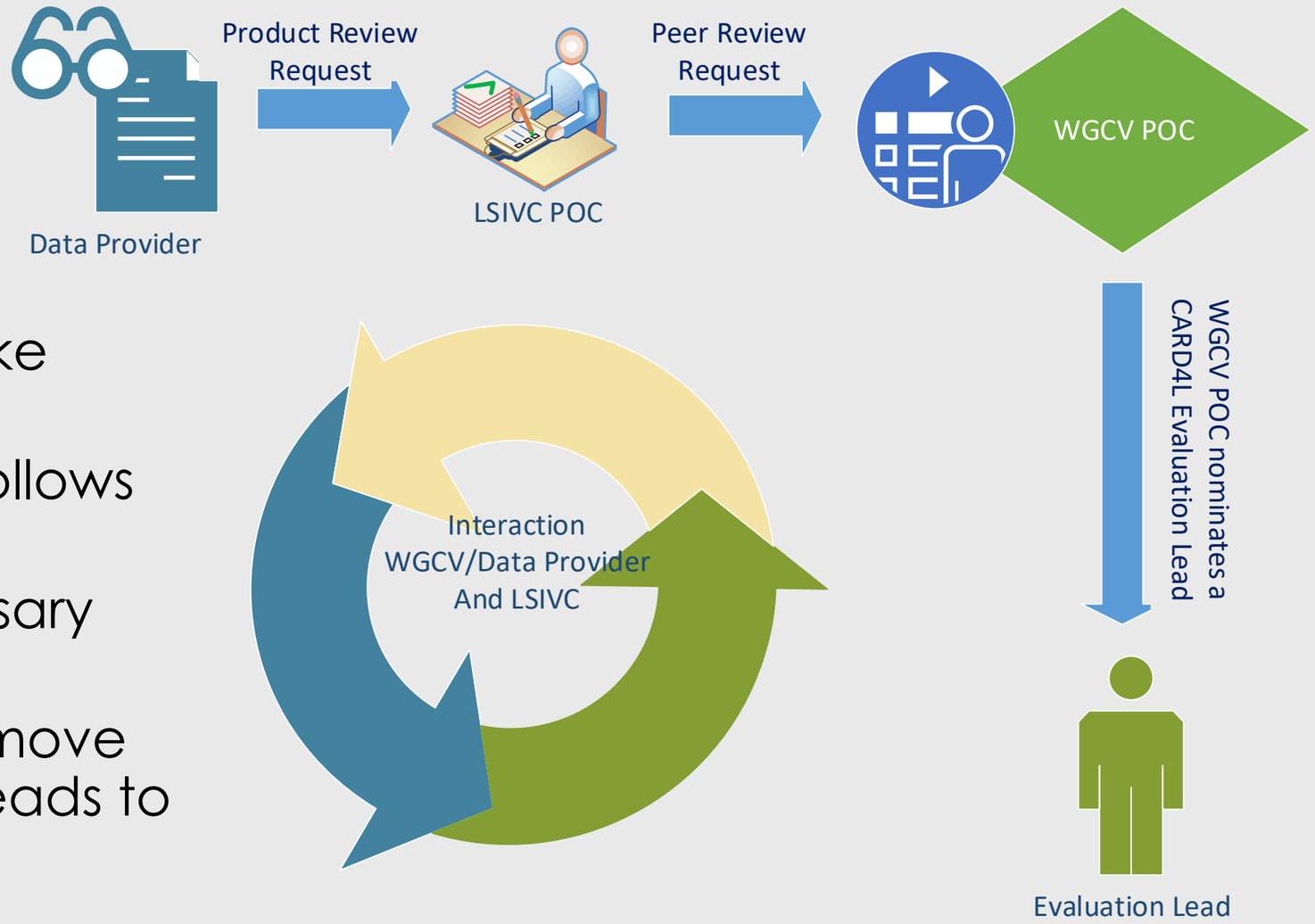


WGCV CARD4L Assessment
Evaluation is collaborative

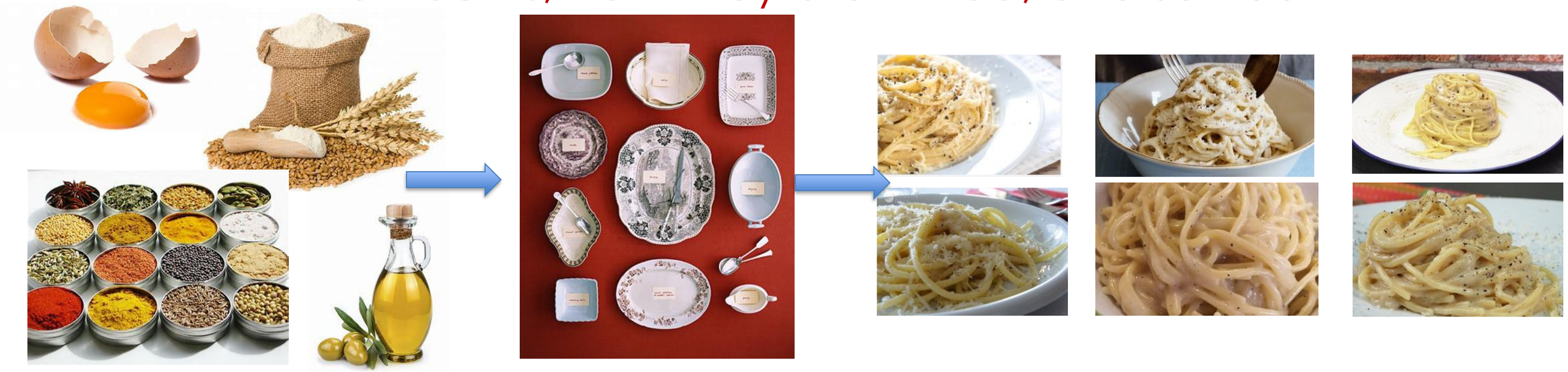
Evaluation process is interaction between WGCV representative, Data Provider, and LSI-VC

- Collaborative process much like WGCV has for RadCalNet
- Help ensure documentation follows accepted nomenclature
- Clear demonstration of necessary quality
- Goal is to help Data Provider move toward documentation that leads to acceptance



WGCV peer review of CARD4L Self Assessments

Help data provider document impacts of choices of ingredients, amounts, how they are mixed, and served



- WGCV process attempts to ensure consistency of documentation process across providers and data product families
- Documentation is responsibility of data provider
- Validation of PFS metrics is data provider's responsibility

Summary

Details of WGCV's assessment process still being finalized

- Pilot projects for data provider's self-assessment and production process will help finalize process
- Ensuring process works for Surface Reflectance, Surface Temperature and Radar Backscatter is a challenge
- WGCV working with LSI-VC to communicate information on CARD4L products
  - Appropriate validation approaches
  - Understanding uncertainties
  - Defining Quality Assurance (QA) protocols and cross-validation projects across all product families
- Result is that harmonization should be more straightforward

ARD – S2/L8 Harmonized Sen2like product